New Jersey
Department of Environmental Protection

Division of Air Quality

Technical Manual 1302

Revised January 2006

Pilot Plants and Dual Plants

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I. DEFINITIONS

Department: New Jersey Department of Environmental Protection

Dual Plant: Facility where the same pieces of equipment are used for both R&D and manufacturing operations.

Other Air Contaminant: Any contaminant subject to section 112(r) of the Clean Air Act, any stratospheric ozone-depleting substance (as defined in N.J.A.C. 7:27-8), any greenhouse gas (as defined in N.J.A.C. 7:27-8), acetone or sodium hydroxide.

Pilot Plant: Facility used primarily to produce materials for research and development in chemical and pharmaceutical operations, establish improved methods of manufacturing, or gather data in assessing process feasibility.

Pollutants Of Concern (POC): Include all air contaminants listed in the Department's Health Risk Assessment Spreadsheet available at www.state.nj.us/dep/aqpp/risk.html.

Product Days: A product day is the manufacture of any one product for commercial sale in any calendar day. For example, manufacturing three different products in one day is considered to be three product days. Manufacturing one product over a three-day period is also considered to be three product days.

Research and Development Facility (R&D): see N.J.A.C. 7:27-22.1.

R&D Operation: An operation that performs R&D for similar families of end products and/or processes and is managed and/or operated independently from other R&D operations.

Toll Operations: Facilities that produce formulas or products for many clients. The same formula or product may be produced many times or new materials may be manufactured on a regular basis. This does not include research and development.

II. INTRODUCTION

1. The purpose of this manual is to define procedural and substantive requirements for completion of a "Pilot Plant" or "dual plant" type permit application, as classified by the Department, and the review thereof.

2. Information provided in this manual should be used as reference guidance only. Each permit application is reviewed considering individual characteristics (potential to emit, type and size, location, air quality impacts, etc.) of the proposed equipment and the available air pollution control technology to determine the specific maximum allowable emission rates of air contaminants.

3. Each R&D operation, as defined in this manual, is limited to 90 product-days of commercial manufacturing in a calendar year.

III. BACKGROUND

1. N.J.A.C. 7:27-8 lists categories of equipment which require air pollution control permits to construct and certificates to operate from the Department of Environmental Protection. Included in the many types of equipment covered under these categories is equipment found in pilot plants.

2. Pilot plants are facilities used to run larger-scale versions of laboratory experiments which appear to hold the promise of a new product or a better way to manufacture an existing product. Typical goals of pilot plant experiments are: confirming feasibility and optimizing processes; providing design data for commercial scale plants; determining optimum materials of construction; testing operability of control schemes; determining the extent of plant maintenance; assessing environmental and disposal options; and producing sufficient quantities of product for testing and market evaluation.

3. In the context of this procedure, pilot plants are used for research, development, and testing activities. The pilot plant will produce material primarily for the purpose of R&D, rather than for sale. In certain circumstances, income could be generated from products made in pilot plant facilities such as sale of the research material in lieu of disposal as waste and during process optimization studies when commercial grade product is produced and placed into commercial product inventory or used in test marketing.

4. Pilot plants may be either single-purpose or multi-purpose. The single-purpose facility is designed to test a single process or produce a single product, often over a short time period, and is unlikely to be used again after the experiment. Multi-purpose research pilot plants are intended to remain in use indefinitely and are often found to contain a variety of equipment which can be configured in many different combinations depending upon the experiment to be conducted.

IV. PURPOSE

1. The standard air pollution control permit process includes the submittal of detailed information, such as the raw materials and their percentages for each product. For pilot plant operations, the pre-construction and pre-operation approval of each product is logistically impractical.

2. Unlike other sources, the experiments to be run in pilot plant equipment cannot be reasonably scheduled to provide sufficient time for the completion of the permit application review and approval process. Also, by the nature of the operation, the

operator must have the flexibility to change the experiment as it progresses in order to maximize the beneficial knowledge the experiment is providing. The pilot plant needs the flexibility to make certain reasonable changes without the pre-construction/pre-operation review that would result in unreasonable delays in experimentation.

3. For these reasons, and because of the importance of research to New Jersey, the Department has developed the following alternative air permitting option for pilot plants.

V. APPLICABILITY

Pilot plant equipment may be included in a pilot plant air pollution control permit application if:

1. The pilot plant equipment requires air pollution control permits as specified in N.J.A.C. 7:27-8.

2. All equipment is in a logical grouping such as a research bay or research building(s).

3. The Company has a management system and approval process in place for each experiment.

4. Equipment at the plant is operated in a manner that meets the definition of pilot plant or dual plant.

5. Any permit application for a facility not meeting the definition of 'Pilot Plant' as outlined in this manual will not be eligible for a pilot plant permit.

6. Toll operations that do not meet the definition of "Pilot Plant", as defined in this manual, are not considered pilot plant operations. In this case the conventional procedures of applying for pre-construction approval shall be used. The batch permit procedure would be appropriate for toll manufacturing.

VI. POLLUTION PREVENTION STRATEGIES

The following procedures need to be followed at all times:

1. Establish written clean-up procedures for accidental spills. The nature of the procedure is based on the volume of chemical used and its inherent hazard.

2. Do not evaporate containerized volatile liquid wastes as a means of waste disposal.

3. Keep containers of VOC materials closed when not in use.

4. Evaluate pilot plant VOC operations involving heating, evaporating, sparging, or vacuum application to determine the applicability of trapping and/or controlling emissions.

5. When cleaning pilot plant equipment with solvents, rinsate will be collected for liquid waste disposal.

6. Do not vent toxic gases from pressurized storage cylinders as a method of disposal, unless vented through a Department-approved gas disposal system.

7. Establish a method, for incorporation into written policies and procedures, to track and keep records of actual emissions per experiment.

VII. PILOT PLANT PERMITTING PROCEDURE

The primary difference between the pilot plant permitting approach and the standard air pollution permitting process is that the Department will not review each experiment in advance. The Department will, however, set emission limits (short- and long-term) in accordance with applicable regulations. The Company must have a management review procedure in place to ensure the limits are met for each experiment.

The permitting process for pilot plants will be consistent with the following elements:

- Application Format
- State-of-the-Art Requirement
- Management Oversight and Approval
- Demonstration of Control Device Performance
- Continuous Emission Monitoring
- Recordkeeping and Reporting
- Dual Plant Permits
- Production in the Pilot Plant
- Health Risk Assessment
- Changes to Pilot Plant After Initial Approval
- Potential To Emit (PTE)
- Emissions Calculations Methodology

Each of these elements is discussed below:

A. Application Format

Owners or operators of pilot plants who are seeking to permit their equipment and control device under this alternative permitting option must submit an application which contains the following elements:

1. A statement of the purpose of the pilot plant.

2. A Pilot Plant Air Pollution Control Permit Application in the batch plant format and using the RADIUS software available at *www.state.nj.us/dep/aqpp*. The following guidance is meant to supplement the RADIUS batch plant guidance, and can be used to format the application:

   a) All equipment may be combined into one equipment set, even if the pieces of equipment are not the same type (i.e. reactors, receivers, mixers…)

   b) Control devices may be combined into one control device set.

   c) All emission points may be combined into one emission point set. However, if health risk assessment considerations dictate the use of specific emission points for certain air contaminants, then those emission points must be included in separate sets.

   d) One or more worst-case operating scenarios may be used. Each operating scenario should indicate the equipment numbers or equipment sets, control device numbers or control device sets and emission point numbers or emission point sets.

3. Detail windows for each piece of equipment and control device must be completed.

4. A list of all raw materials, by category, that will be used in the Pilot Plant. The list is to be provided on the attached Raw Material/Air Contaminants List form (NJEMS-03). Categories for raw materials and air contaminants are defined in N.J.A.C. 7:27-8 (Appendix 1) and are: VOC (total), TSP, PM-10, CO, NO_x, SO_2, HAPs and "Other air contaminants" as defined in this manual. The Hazardous Air Pollutants (HAP) and "Other air contaminants" need to be speciated and listed individually.

5. There shall be only one pilot plant permit application per facility. The application may include one or more R&D operations as defined in this manual. Each R&D operation should be represented in the RADIUS permit application by a separate "BP" and will be limited to 90 product-days of commercial manufacturing in a calendar year.

B. State-of-the-art (SOTA) Requirements:

In accordance with N.J.A.C. 7:27-8, air pollution control permit applications are required to incorporate advances in the art of air pollution control (SOTA) developed for the kind and amount of air contaminant emitted.

C. Management Oversight and Approval

All documents subject to Department review must be signed by a person with direct knowledge. All submitted documents with a certification statement(s) must be signed by the individual(s) as required in each form pursuant to N.J.A.C. 7:27-1.39.

D. Demonstration of Control Device Performance

The Department reserves its rights and authority to require stack testing of any source operation in accordance with N.J.A.C. 7:27-8. The Department will make such determinations on a case-by-case basis.

E. Continuous Emission Monitoring

The Department reserves its rights and authority to require continuous emission monitors if deemed necessary. The Department will make such determinations on a case-by-case basis. Any required emission monitors must be approved by the Department's Bureau of Technical Services (BTS). It is advisable that the Applicant seek approval from BTS prior to purchase.

F. Recordkeeping and Reporting

1. All reports, calculations and other documents associated with the review process will be maintained on-site for five years and made available to the Department upon request. Post-Experiment Review forms (Form NJEMS-01) will be completed by the Individual with Direct Knowledge once per experiment, within seven days of completion of the experiment. In addition to these forms, the facility must maintain experiment records sufficient to document the experiment. These records must include emissions calculations, process flow diagrams, batch sheets or other records that identify the inputs to the emissions calculations, the pieces of equipment, materials and configuration used during the experiment. The Permittee shall keep totalized quarterly emissions records.

2. Annual reports, based on the previous calendar year, must be sent to the Department's Regional Enforcement Office and Bureau of Air Quality Evaluation and must be received by April 1st of each year. If the report due date falls on a weekend or holiday, the report is due the next business day.

3. The report will include the Post-Experiment Review Form (Form NJEMS-01) for each experiment that may have exceeded any allowable emission rate or any other permit limit, and the Annual Report, Pilot Plant Emissions Summary (Form NJEMS-02). Each Post-Experiment Review Form where emissions did not exceed any

allowable emission rate or any other permit limit will be retained at the facility with all other documentation required by this manual.

4. Control devices which generate emissions in categories other than the controlled category (e.g. thermal oxidizing units) must report the actual emissions for these categories. These emissions must be included in the annual reports. Operations involving routine cleaning of equipment may be excluded from the Post-Experiment Review forms. However, emissions generated or caused by such operations must be documented in the Annual Report.

5. The master list of all raw materials will be kept on site with the above documents and will be updated, on site, each reporting period.

6. During routine inspections by the Regional Office, equipment, control device and emission point identification is necessary. As a condition of pilot plant and dual plant permit approvals, all sources, control devices and emission points (where feasible) must be marked with easily readable designations or noted on appropriate diagrams. These designations must correspond to the information provided on inventories and diagrams, as provided in the permit application. Emission points must be identified on a roof drawing.

G. Dual Plant Permits

1. If pilot plant and batch production operations share the same equipment or facility, a dual permit may be obtained. This type of operation requires a two-part air permit application. The two parts, Batch Plant and Pilot Plant, must follow the requirements of their respective procedures (Technical Manual 1301 for Batch Plants and Technical Manual 1302 for Pilot Plants) and must contain all the information required in the procedures. In addition, due to the different requirements between Batch and Pilot operations, separate Raw Materials Lists must be submitted.

2. For major sources with an approved Title V permit, manufacturing operations and R&D may be under one Title V Operating Permit. Another option is to have the manufacturing operations in the Title V permit and the R&D operations in a separate preconstruction permit. For all other sources, both manufacturing and R&D operations shall be combined in a single dual permit.

3. Reporting of emissions for the Dual permit will be on the forms provided in the Appendix. Note that the total tons per year by pollutant category is not required to be the sum of the Batch and Pilot Plant operations. However, the Batch Plant and Dual Plant (total for the permit) Tons per Year limits are all enforceable. Reporting must be provided on the Annual Report, Dual Plant Permit Emissions Summary (Form NJEMS-04) in addition to the Post-Experiment Review Form (Form NJEMS-01) as required in this manual.

H. Production in the Pilot Plant

1. Products for commercial market may be made in pilot plant facilities for periods up to 90 product-days per calendar year per R&D operation, provided that the commercial production operations are subject to the pilot plant management oversight and approval procedures including management certification of the Post-Experiment review form. The on-site records must include the product name, date of manufacture and the number of product days used. The annual report must include the number of product days used for the calendar year.

2. If the manufacturing of products for commercial markets will continue for more than 90 product-days, permits for batch plant manufacturing activity must be applied for as part of the pilot plant permit (Dual Permit) or accommodated in a facility's Title V permit. The company is required to keep records of the above commercial manufacturing operations. For pilot plants using the 90 product-day option, on-site records must include the product name, date of manufacture and the number of product days used.

3. Production for commercial markets under a pilot plant permit must stop after the 90-product-day limit. Filing for the Dual Permit represents a modification to the certificate and must be approved by the Department prior to resuming such production activities.

I. Health Risk Assessment

1. Health risk assessment is a scientific process used to estimate the probability of adverse health effects resulting from human exposure to hazardous substances.

2. Pilot plant applications, with potential emissions of any pollutant of concern, per piece of equipment, above reporting thresholds listed in N.J.A.C. 7:27-8, will be required to conduct a health risk assessment analysis for short term (lb/hr or lb/batch-cycle hour) and long term (tons/yr) emissions. The instructions for pilot plant risk assessment are outlined in the Appendix.

J. Changes to Pilot Plant After Initial Approval

Permit modifications must be sent to the Department with the appropriate completed RADIUS application (e.g. Revision, Compliance Plan Change or Amendment) and the revised/new sections to be added to the existing permit application. The Applicant needs to update all information including, but not limited to, the raw materials list and all inventories. However, the entire permit application does not need to be resubmitted.

- ***Changes that could be made as N.J.A.C. 7:27-8 permit amendments:***

(a) Addition of a new piece of equipment or reconstruction or replacement of an existing piece of equipment may be made as amendments provided they meet the following:

1. No new applicable requirement is triggered for the pilot plant (i.e. NSPS, NESHAP, MACT etc..);
2. SOTA is not triggered;
3. No increase in potential emissions for the pilot plant;
4. No new air contaminant (or air contaminant category) is being emitted above reporting thresholds;
5. No increase in air quality impacts and estimated off-site health risk based on the air dispersion modeling analysis and health risk assessment for the pilot plant; and
6. The piece of equipment is not a heater, boiler, incinerator, diesel generator or other directly or indirectly fired combustion device.

(b) Modification to an existing emission point, or addition of a new emission point, provided there is no increase in air quality impacts and estimated off-site health risk based on the air dispersion modeling analysis and health risk assessment for the pilot plant, if such assessment is required.

(c) Addition of a new control device, or replacement of a control device with an identical control device, provided that

1. Emissions are below SOTA thresholds;
2. No new applicable requirement is triggered (i.e. NSPS, NESHAP, MACT etc..); and
3. The additional control device is identical to one that is already approved and included in the permit.

- ***Other Changes:***

All other changes shall be handled as stipulated in N.J.A.C. 7:27-8.

K. Potential To Emit (PTE):

1. The PTE section in the permit application shall include the annual emission limits of all air contaminants for each R&D operation, in tons per year, consistent with N.J.A.C. 7:27-8. This section shall also include the hourly emission limits of all pollutants of concern, for each operating scenario, as described below.

2. The hourly emission limits shall be for all pollutants of concern and shall represent the worst case total in any one hour, in lb/hr, for each operating scenario listed in the permit application. These limits shall be used for purposes of health risk assessment as outlined in the Appendix. Hourly emission limits are not required for pollutants of concern for which the emissions, per piece of equipment, are below the N.J.A.C. 7:27-8 reporting thresholds.

L. **Emissions Calculations Methodology**:

1. The air emissions for each air contaminant listed in the permit application shall be determined using an acceptable methodology, combining raw materials usage and other operational parameters.

2. The emission calculation methods listed below are to be used for both the PTE calculations and the Post-experiment calculations. Options for acceptable calculation methods include the following:

    a) Continuous emission monitor
    b) Stack emission testing
    c) Material Balance
    d) Engineering calculations
    e) Emission factors

NJEMS-01

POST-EXPERIMENT REVIEW FORM

1. Test Date _____ Experiment Identification # _____

2. Experiment Title_____

3. ____ Check here if permit limit was exceeded.

4. Continuous Emission Monitors used (if applicable) _____

5. Product Days consumed by experiment: _____

6. Air Contaminants

Air Contaminants	CAS#	Lbs emitted per experiment
Total VOC	N/A	
TSP	N/A	
PM-10	N/A	
CARBON MONOXIDE	N/A	
NITROGEN OXIDES	N/A	
SULFUR DIOXIDE	N/A	
HAPs (list individually)		
"Other Air Contaminant" (list individually)		

7. If a control device was used, list its operating parameters
   _____

8. Include , as an attachment to this form, calculations showing how the emissions were derived for each pollutant. Refer to Section L of this manual.

9. Include, as an attachment to this form (or reference location of appropriate files that are readily accessible), a diagram showing piece(s) of equipment, control device(s) and emission point(s) for each experiment. Batch records showing the same information may be used instead of a diagram.

Any exceedance of operating or emission requirements specified by the Department must be reported to the Regional Office within three working days, in writing, after knowledge of the exceedance. However, any operation of the equipment which may cause off-

property effects, including odors, shall be reported immediately by calling the HOT LINE 1-877-WARN-DEP (1-877-927-6337), in accordance with the Air Pollution Control Act, 26:2C-19(e).

"I certify under penalty of law that I believe the information provided in this document is true, accurate, and complete. I am aware that there are significant civil and criminal penalties, including the possibility of fine or imprisonment or both, for submitting false, inaccurate or incomplete information."

_____	_____	_____	_____
Name of Individual With Direct Knowledge	Title	Signature	Date

A signature is required below if any exceedance of an allowable emission rate, or any other permit limit, occurred.

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attached documents and, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil and criminal penalties, including the possibility of fine or imprisonment or both, for submitting false, inaccurate or incomplete information."

_____	_____	_____	_____
Name of Responsible Official	Title	Signature	Date

NJEMS-02

ANNUAL REPORT
Calendar Year: _____

PILOT PLANT EMISSIONS SUMMARY

Pollutant Category	Emissions (Tons)				
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Annual
Total VOC					
TSP					
PM-10					
CARBON MONOXIDE					
NITROGEN OXIDES					
SULFUR DIOXIDE					
HAPs (list individually)					
"Other Air Contaminant" (list individually)					
Number of Product-Days of Commercial Manufacturing per R&D Operation					

NJEMS-03

RAW MATERIALS/AIR CONTAMINANTS LIST

Raw Material	CAS Number
Total VOC	NA
TSP	NA
PM-10	NA
CARBON MONOXIDE	NA
NITROGEN OXIDES	NA
SULFUR DIOXIDE	NA
HAPs: (list individually)	

"Other Air Contaminant**"** (list individually):

NJEMS-04

ANNUAL REPORT
Calendar Year: _____

DUAL PLANT PERMIT EMISSIONS SUMMARY

Pollutant Category	Annual Emissions (tons)		
	Pilot Plant	Batch Production Plant	Permit Total
Total VOC			
TSP			
PM-10			
CARBON MONOXIDE			
NITROGEN OXIDES			
SULFUR DIOXIDE			
HAPs (list individually)			
"Other Air Contaminant" (list individually)			

APPENDIX

HEALTH RISK ASSESMENT PROCEDURE FOR PILOT PLANTS

1) List all Pollutants of Concern (as defined in this manual) that will be emitted by the equipment that is to be included in the Pilot Plant Permit.

2) For Pollutants of Concern with potential emission rates greater than their corresponding reporting threshold per piece of equipment, as listed in Appendix 1 of N.J.A.C. 7:27-8, provide the worst case emission rate in lb/hr or lb/batch-cycle hour for each operating scenario (if it is different from the total hourly rate obtained by adding the emission rate from all pieces of equipment) and the worst case annual emissions (in tons per year) for the entire permit.

3) For Pollutants of Concern with potential emission rates below their corresponding reporting threshold per piece of equipment, as listed in Appendix 1 of N.J.A.C. 7:27-8, it is not necessary to quantify emissions, but it should be noted that emissions of such pollutants of concern are below each applicable reporting threshold.

STEP 1:

Using the Health Risk Screening Worksheet available at
www.state.nj.us/dep/aqpp/risk.html

a) Calculate the average ambient air concentration (C) using the shortest stack and smallest distance to property line.

b) Set Q = the emission rate for each pollutant of concern that is listed explicitly in the permit application.

c) If IR $\leq$ 1.0E-5 (ten in a million cancer risk) and HI is $\leq$ 1 (values < 1.5 should be rounded down to 1), then the health risk assessment is acceptable. If either one or both are greater than these thresholds, proceed to Step 2.

STEP 2:

Providing more detailed information about the most toxic Pollutants of Concern on the application.

a) Commit to directing the most toxic pollutants to taller stacks, or

b) Commit to limiting most toxic pollutant emissions to buildings more distant from the property line, or

c) Divide the Pollutants of Concern into groups (such as HAP-VOCs, metals, etc) and then show how emissions within these groups will be capped by other limits in the permit. For example, if there are 10 Pollutants of Concern that are HAP-VOCs and each has a permit limit of 1 TPY, but the overall cap for HAP-VOCs is 5 TPY, then we know that the total risk from this group cannot be greater than the risk associated with emissions of the 5 most toxic pollutants emitted at their permit limit.

d) Using any combination of a, b, & c above, rerun the risk assessment using the worksheet with any pollutant-specific information that has been specified. This may require the use of more than one worksheet if you are now using more than one stack height, for example.

e) Add the risk from all of the risk screening worksheets completed in this step. If IR $\leq$ 1.0E-5 (ten in a million cancer risk) and HI is $\leq$ 1 (values < 1.5 should be rounded down to 1), then the health risk assessment is acceptable. If either one or both are greater than these thresholds, proceed to Step 3.

STEP 3:

Prepare a site-specific health risk assessment following a protocol approved by the Department's Bureau of Air Quality Evaluation. At this step, information related to stack gas temperature, distance to nearest residents and other sensitive receptors, use of multiple stacks, and proximity to complex terrain, along with other local parameters will be considered to refine the air dispersion model and health risk assessment. If IR $\leq$ 1.0E-5 (ten in a million cancer risk) and HI is $\leq$ 1 (values < 1.5 should be rounded down to 1), then the health risk assessment is acceptable.